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Understanding Consumer Choices: Towards Sustainable Water Use in India

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Abstract: This study addresses the pressing issue of water scarcity in India, focusing on sustainable water management and the crucial role of consumer behavior. It establishes a clear correlation between safe water access, economic development, and public health, emphasizing the interconnectedness of these factors. The concept of a water footprint, comprising green, blue, and gray components, provides a framework for analyzing global water usage. The socio-economic context highlights the significance of recognizing water as an economic good for efficient resource allocation. Global water availability is discussed, revealing the inadequacies in freshwater distribution and the widening gap between demand and supply. India's precarious position, given its large population, is underscored. Issues related to water consumption, including reckless groundwater exploitation, emphasize the need for stakeholder involvement and a paradigm shift in water management. The study stresses the urgency of an action plan for sustainable water management, advocating strategies such as storage, conservation, and recycling. Disproportionate water usage in agriculture and urban inefficiencies are addressed, urging modernization and technological advancements. Public engagement emerges as pivotal, with consumer behavior significantly impacting water usage patterns. The study discusses the role of public feedback "report cards" in promoting accountability among service providers, whether private or government-owned. Highlighting growing awareness in India, referencing NITI Aayog's Composite Water Management Index, the study emphasizes the disparity between population and freshwater resources. Groundwater depletion and per capita water use statistics underscore the need for immediate action. The study explores untapped water supply sources, advocating for the reduction of system leakage and promoting rainwater harvesting. The potential of stormwater and wastewater management is discussed, emphasizing the importance of incorporating green infrastructure solutions. In conclusion, the study underscores the significance of studying consumer behavior to enhance water conservation strategies. Recommendations include assessing consumer awareness, understanding utilization patterns, and perceptions affecting economic impact. The research advocates for a paradigm shift in water use and recycling, emphasizing the critical role of consumers in shaping a sustainable water future for India.

Keywords: Water conservation, Consumer Behaviour, Water Harvesting, Water Resources.

Introduction

"*The earth, the air, and the water are not an inheritance from our forefathers but on loan from our children. So, we have to hand it over to them at least as it was handed over to us-* ***Mahatma Gandhi".*** Water scarcity is a growing global concern. India, as one of the most water-stressed nations, faces unique challenges in managing its water resources which extensively affect the ecosystem and agriculture. Water plays an extremely important role on the earth's surface. It is so familiar with our daily lives that we often forget its importance. It covers 71 percent of the Earth's surface (CIA 2008). Water on earth moves continually through the water cycle of evaporation and transpiration, condensation, precipitation and

runoff, usually reaching the sea.Clean water is essential to any form of life. Access to safe drinking water has shown improvement in almost every part of the world over the last few decades. However, approximately one billion people still lack access to safe water, and over 2.5 billion people lack access to adequate sanitation (United Nations 2008).

There is a clear correlation between access to safe water and gross domestic product per capita (Kulshreshtha 1998). This correlation is rooted in the interconnectedness of health, productivity and economic development. It is generally believed that countries with higher GDP per capita tend to have better infrastructure for providing clean water and sanitation services to their citizens. Conversely, countries facing challenges in providing clean water often experience adverse impacts on health, education and economic growth. Good quality water supply and sanitation are vital for protecting the environment, improving health and alleviating poverty. According to a press release from the United Nations, water-related diseases kill a child every eight seconds and are responsible for 80 percent of all illnesses and deaths in the developing world. This situation is made all the more tragic by our long-standing knowledge that these diseases are easily preventable (United Nations 2003). Contaminated water and poor sanitation are linked to transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio.

Water Footprint

The concept of water footprint provides an appropriate framework of analysis to find the link between the consumption of animal products and the use of global water resources. It measures the amount of water used to produce each of the goods and services we use. The water footprint tells us about how much is being consumed by a particular country or globally in a specific river basin or from an aquifer.

The water footprint has three components: green, blue and gray.

Green – Denotes rainwater consumed

Blue – Surface and groundwater consumed

Gray – Volume of fresh water required to assimilate pollutant load as per the existing ambient water quality standards (Mekonnen and Hoekstra 2011).

Socio- Economic Context

Water plays complex environmental, social and economic roles, some of which have long-term implications. Water is a public good and has a social and economic value in all its competing uses. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources. Past failure to effectively manage water resources is associated with failure to recognize the economic value of water. Recognizing water as an economic good is a key decision-making tool to distribute water among different sectors of the economy and different users within sectors. Water cost and charge are two different things that should be clearly differentiated. Water cost refers to the expenses incurred by the water utility in providing water to its customers. These costs include the costs of treating the water to make it safe for consumption, the energy required to move and deliver the water, and other operational costs. On the other hand, water charge is the price that the customer pays for the water they use. This charge is typically made up of a fixed charge and a variable charge. The fixed charge is a set amount that the customer pays regardless of how much water they use, while the variable charge is based on the volume of water used and reflects the costs of providing the water (USEPA 2023).

Water Availability

While fresh water supplies are adequate to meet demand for the foreseeable future, the world's freshwater is poorly distributed across and within countries and between seasons. Hence practical distribution problems covered with location, space and affordability lead to a widening gap between demand and supply in many parts of the world. The fresh water resources in the world are estimated to be 43750 km^3/year. This water is distributed throughout the world, according to the patch work of climate and physiographic structure (Sharma 2010). Table 1 shows the fresh water supply in a few countries of the world. The table shows that India's position is far below in terms of water supply when the country's population is largest.

Table 1: Fresh Water Supply in Top Ten Countries

Country	Total FreshWater Supply (km^3/year)
Brazil	8233
Russia	4508
USA	3069
Canada	2902
China	2840
Colombia	2132
European Union	2057
Indonesia	2019
Peru	1913
India	1911

Source: Fao Corporate Document Repository

Issues related to water consumption are the focus of public debate particularly at times of scarcity. Counting reckless exploitation of groundwater, leading to the rapid depletion of acquifers in many places portends disasters. There may be a need for changes in the law relating to ownership rights over ground water, establishment of regulatory bodies, rationalization of power tariffs and so on. The present mindset of a majority of the population is that water is government's business. This needs to be replaced by a model in which all major stakeholders participate at all levels. Without this change LMP solutions will be of no use.

Public Conception

The involvement of private companies in the drinking water industry, coupled with the depletion of water resources and increasing demand, has intensified the ongoing debate. Thus, when considering the societal and political aspects of water, it becomes crucial to take into account the diverse public reactions, shaped by individuals' beliefs, values, knowledge, attitudes and behaviours. This approach allows us to classify peoples' perspectives into the following four dimensions (Shah 1994).

Affective dimension- This includes people's perception about future water availability, belief about sustainable water supply system and views about efficient use of available water.

Cognitive dimension- People's knowledge about hydrological cycle, fresh water available and the players who are involved in the supply and use of water.

Co-native dimension- People's appreciation of various water management and distribution policies, guidelines and regulations in incoming water supply and reducing demand.

Active dimension- Behaviour of population with regard to water consumption.

The opinion of the people is influenced by a number of social factors such as type of user, type of activity, type of business, family income and type of households. Demographic factors viz. age and sex, cultural factors, viz. educational level and value system and contextual level i.e. level of water supply (low, medium etc.) also play a major role. Thus, the position of various stakeholders in water debate will depend upon variable like water rights and management schemes, cost of water, criteria for water supply to different users etc.

The consumers can be broadly categorized into two categories:

Productive Consumers- The consumers who use water for production. both agricultural production and industrial production.

Domestic Consumers- For domestic consumers, the consumption of water is dependent upon the cultural pattern and availability rather than the industrial rationale.

Within these two overarching groups, numerous subgroups emerge, influenced by factors such as the type of production for productive consumers and the socio-cultural and demographic characteristics of domestic consumers.

Need for Action Plan

Creating an action plan for water resources is crucial to ensure the sustainable management, preservation, and equitable distribution of this valuable natural asset. Globally, we are grappling with escalating challenges of water scarcity and pollution. An effective strategy can be instrumental in addressing these pressing concerns.

The key lies in enhancing water availability through strategies such as storage, conservation, reduction of wastage, recycling, and reuse. One urgent priority is the establishment of major, medium, and minor water storage facilities to harness the immense untapped monsoon flows, which are currently being discharged into the sea each year.

Agriculture not only represents the largest consumer of water worldwide in terms of volume, accounting for over two-thirds of water withdrawals from rivers, lakes, and aquifers, but it also utilizes water inefficiently and receives substantial subsidies. Additionally, urban areas divert valuable water resources through leaky distribution systems, often supplying them to underpaying or non-paying customers. This wasteful practice should not persist when viable solutions exist.

To improve this situation, we must adopt contemporary water management practices, focusing on enhancing efficiency. This includes the modernization and rehabilitation of inefficient irrigation systems and the replacement of traditional, outdated systems with modern technology-based alternatives.

Implementing measures such as demand-oriented water management, the adoption of improved irrigation techniques, and the introduction of innovative water management technologies through technology transfer can significantly reduce losses and enhance the availability of freshwater.

Warning signs are already evident, indicating that we have nearly exhausted the renewable freshwater supply that the hydrological cycle can generate. We must not wait for a crisis or a breaking point to act. Instead, we should proactively address the challenges of conserving and managing our water resources through a range of short-term and long-term measures outlined in comprehensive action plans. By doing so, we can pre-emptively mitigate conflicts and build a sustainable framework for water management.

Public Engagement and Transforming Behaviour

Universal access to clean water is far from a reality in many developing countries. In India, access to clean water remains a major challenge-only two thirds of Indians have access to clean drinking water, and arsenic contamination in groundwater has interrupted efforts to decrease surface water intake. Water

scarcity is a critical issue in India, exacerbated by population growth, urbanization, and climate change. Water scarcity is a pressing concern for India due to its large and growing population. Consumers play a pivotal role in water conservation, and their behaviour and perception significantly impact water usage patterns.

User perceptions on the quality, efficiency and adequacy of the various services can be aggregated to create a 'report card 'that rates the performance of all major service providers in the cities and rural areas. By systematically gathering and disseminating public feedback, report cards may serve as a 'surrogate for competition' for monopolies- usually government owned- that lack the incentive to be as responsive as the private enterprise to their client's needs.

Growing Awareness in India

The NITI Aayog's 2018 Composite Water Management Index (CWMI) depicts an unsettling picture of macro-water availability in India-despite being home to 17% of the world's population, it has only 4% of the world's freshwater resources. The total water demand in India is projected to increase by 22% and 32% in 2025 and 2050 respectively and by 2050, 85% of this demand is expected to come from industrial & domestic sectors alone (Pundir, N. 2023).

The Union Water Resources Ministry, Govt. of India tracks ground water levels at 15000 stations across India. "Groundwater is being heavily withdrawn in certain areas such as Haryana, Rajasthan, Delhi and Punjab" said S.K. Sharma, a ground water consultant with the Ministry. Scientists using data from NASA's Gravity Recovery and Climate Experiment (GRACE) have found that the groundwater beneath Northern India has been receding by as much as one foot per year over the past decade. After examining many environmental and climate factors, the team of hydrologists led by Matt Rodell of NASA's Goddard Space Flight Center, Greenbelt, Md. concluded that the loss is almost entirely due to human consumption (Schindler 2023).

The total freshwater withdrawal in India was estimated to be 645.84m^3/year in 2000. The per capita withdrawal was 585m^3/year (47m^3/year for domestic, 32 m^3/year for industrial and 506 m^3/year for agricultural purposes) which works out to be approximately 1600 liters per day. Out of this, 8 percent is for domestic use, 5 percent for industrial use and 86 percent for agriculture use (Table 2). In India up to 2002, 96 percent of the urban and 82 percent of the rural population had access to safe drinking water, with an overall average of 86 percent.

Table 2: Per Capita Freshwater Use in Different Sectors in India in 2000

Category	**Quantity used (m^3/year)**	**Percent of total water used**
Domestic	47	8
Industrial	32	5
Agriculture	506	87
Total	**585**	**100**

Source: Ministry of Water Resources, River Development & Ganga Rejuvenation, wrmin.nic.in

Being an agrarian country, irrigation by far is the largest user of India's water reserve with hooping usage of 78% of total water reserve, followed by domestic sector (6%) and industrial sector (5%) (Asian Development Research Institute 2013)

Water Conservation Methods: Future Outlook

Despite the awareness, the large-scale adoption of water efficiency measures, policies and comprehensive programs is still very rare. We have yet to see the full potential of water conservation, and we really don't have any idea of what a 'sustainable water use system' really looks like. It reveals that despite the existence of a plethora of water efficiency technologies, products and practices that can be applied to each water use sector, thus far, practical "water conservation programs" as implemented by water utilities are very limited. Water and wastewater treatment plants are the most energy-intensive facilities operated by local governments, accounting for anywhere from 30–60% of a municipality's total energy bill. Next to operator salaries, electricity is the second highest operating cost wherein electricity used for pumping is the highest (Kumar 2013).

Untapped Water Supply

System water leakage is chronically underestimated, ignored or treated as a tired "Unsolved Mystery" by most water suppliers, yet it is one of the most cost-effective and accessible sources of additional supplies available. How much water can be recovered by reducing system leakage?. System unaccounted for water (UFW), usually described as the percent of total water produced, is a measure of both leakage and unmetered uses. Historically, utilities have balked at including UFW evaluations and measures to recover lost water in water conservation plans as high less figures are politically embarrassing, particularly when a utility is in the process of making expansion plans due to supply shortfalls (Vickers 1999).

Rainwater Harvesting

Water recycling through rain water harvesting is a simple, effective and economical solution to conserve water so that more fresh water is available for essential uses, such as drinking, bathing, cooking and laundry. There is a limit to increasing water supply because we are running out of sources and the cost of additional facilities is prohibitive.

If India manages to catch just 2 percent of the annual rainfall it receives, one billion people in the country can be provided with 100 liters per person per day throughout the year. A family of five (not referring to people in urban areas who are water guzzlers) requires six to seven liters of potable water for drinking and cooking every day, which comes to around 11,000 to 12,000 liters in a year (Sharma 2009).

Surface for Rain Water Harvesting

Rooftops- If buildings with impervious roofs are already in place, the catchment area is effectively available free of charge and they provide a supply at the point of consumption. Paved and unpaved areas, i.e. landscape, open fields, parks, storm water drains, roads and pavements and other open areas can be effectively used to harvest the runoff.

Water bodies- The potential of lakes, tanks and ponds to store rain water is immense. This water can be effectively used for irrigation.

Storm Water drains-. Most of the residential colonies have a proper network of storm water drains. If maintained neatly, these offer a simple and cost-effective means for harvesting rain water.

Managing Storm and Wastewater

The steps in establishing a storm-water utility are nearly identical to starting a successful local onsite waste-water management programme, as evidenced by the experience of the communities who have found themselves on a decentralized management path. Rain water through storage will only serve the purpose if properly filtered to meet the major drinking water needs. For this effect, a major invention in the field has been made which provides proper rain water purification mechanisms. This purification system works on the normal treatment method involving screening, flocculation, sedimentation and filtration.

Construct and maintain proper stormwater drainage systems, including ditches, culverts, and retention basins to manage runoff during heavy rainfall. Upgrade wastewater treatment plants to handle increased loads during storm events and prevent overflow. Incorporate green infrastructure solutions like permeable pavements, green roofs and vegetated swales to capture and treat storm water naturally. These methods reduce runoff, filter pollutants and recharge groundwater.

Filter Waste Water

For traditional waste-water filtration, gravity downfall granular filters using sand or anthracite as a medium are commonly used. One major problem with these filters is that upon back-washing the particles, the large ones settle at a greater rate than the smaller ones. Crumb rubber can be used for this, which is compressible and the porosity of the particles is decreased, resembling an ideal filter medium configuration. It can then be used at higher filter rates while performing similarly to other media (Xie 2007).

When designing a wastewater filtration system, consider factors such as the type of contaminants present, the required treatment level, the flow rate of wastewater, available space, and the budget. It's important to integrate filtration into a comprehensive wastewater treatment process that includes other treatment steps like screening, sedimentation, biological treatment and disinfection.

Regular maintenance and monitoring of filtration systems are crucial to ensure their proper functioning and effectiveness. The choice of filtration method should be based on the specific requirements of the wastewater treatment facility and the quality of treated water desired.

Conclusion and Suggestions

The study of consumer behaviour helps municipal corporations and organisations to improve their water conservation strategies by understanding issues such as the psychology of the consumer, what he understands about the availability of product, which is water in the present context, how the consumer is influenced by the environment where he lives in, what are the limitations in consumer knowledge or information processing abilities.

Consumer behaviour is actually a subset of human behaviour. That is, factors affecting individuals in their daily lives also influence their purchase activities. Another environmental factor which influences consumer behaviour is the situation. Situational influence has been defined as the influence resulting from factors that are particular to a specific time and place and independent of consumer characteristics i.e. influence from products or publicity. The conservation strategy is mainly concerned with saving water but at the same time ensuring consumers' satisfaction with a superior and timely supply. The demand for any commodity / consumer good is related to the consumer behaviour and perception about that commodity. Thus, it is high time to study the consumer's awareness about the present water resources, utilization pattern, quality of water used and perception about affecting the economy in water use and utilizing recycled water.

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